AbstractID: 13849 Title: Contrast to Noise Ratio Measurements for Real Time MR Lung Tumour Imaging Sequences at Lower Fields – A Phantom Study

Purpose: Magnetic Resonance Imaging (MRI) has been proposed for real-time image guidance during lung radiotherapy treatment. Dynamic lung MR studies in the literature have demonstrated the feasibility of real-time tumour tracking at 1.5T scanners. Lower field magnets offer several advantages over high field magnets, but has lower signal to noise ratio and a different contrast environment due to field strength dependences in T_1 and T_2^*. The purpose of this study was to determine the expected contrast to noise ratio (CNR) at 0.2T for several rapid MR sequences by performing experiments in a 3T MRI.

Method and Materials: Lung tumour is simulated by loading solution containing $CuSO_4$ and $MnCl_2$ in a sphere. To simulate the lower relative proton densities (PD) of lung parenchyma, 2mm acrylic beads are uniformly suspended in gelatin. T_1, T_2 and T_2^* and relative PD are measured for the phantom in 3T and compared against their expected values at 0.2T from literature. For real time imaging, rapid gradient echo sequences (FLASH and balanced SSFP) are used to acquire images from 3-10 frames per second using acceleration techniques of halfscan and parallel acquisition. A dynamic noise scan is used to estimate noise and is adjusted to reflect the lower SNR at 0.2T. Measurements are repeated using a body coil and a 6 channel thoracic SENSE coil for parallel imaging.

Results: The measured T_1, T_2 and T_2^* and relative PD of the phantom are similar to the values given in literature. For dynamic lung images, CNR ranges from 9.4-31.7 for bSSFP and 4.0-13.8 for FLASH. In house auto-contouring algorithm shows good quality contours of spherical tumours with CNR > 2.5.

Conclusion: In this phantom study, dynamic lung imaging sequences are shown to provide sufficient tumour-tissue CNR and temporal resolution for real time MR lung tumour tracking at 0.2T.